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Patentanwälte · Augustenstrasse 46 · D - 80333 München

Dr. Hermann O. Th. Diehl · Diplom-Physiker
Joachim W. Glaeser · Diplom-Ingenieur*
Dr. Elmar Hiltl · Diplom-Chemiker
Dr. Frank Schorr · Diplom-Physiker
Dr. Christian Huber · Diplom-Chemiker
Dr. Klaus Hinkelmann · Diplom-Chemiker
In Kooperation mit Diehl & Partner AG
CH - 7513 Silvaplana · Schweiz
Patentanwälte · European Patent Attorneys
München · Hamburg*

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Figure 1 schematically illustrates a conventional pin-shaped cathode, figure 2 is a representation of an embodiment, figures 3 and 4 illustrate a method of manufacturing the composite cathode for an arrangement according to figure 2, and figures 5 to 7 show composite cathodes of different types.

A pin-shaped cathode body carries reference numeral 20 in figure 2. The cathode body consists of two portions 21 and 22 which are integrally fixed to each other. The first pin-shaped portion 21 forms the larger portion of the cathode body 20 and is formed of a metal having a high melting temperature and a low vapor pressure, such as tungsten. The second portion 22 is formed of an electrically conductive material having a lower melting temperature, a higher vapor pressure and a higher electron emission property, such as tantalum. This second portion 22 is disposed at one end of the first portion and provides the electron emitting surface 23. The other end of the pin-shaped metal portion is fixed to a metal plate 25 by an insulating piece 24 formed of ceramics.

Two mounting pins 26 and 27 made of metal are fixed to the metal plate 25 by insulating pieces 28 and 29 made of ceramics. The pin-shaped metal portion 21 is surrounded by a heating coil 30 having a first end soldered or welded to the mounting pin 26, and a second end soldered or welded to the mounting pin 27.

Kanzlei · Offic : München

Telefon · Telephone	Telefax · Facsimile	E-mail/Internet	Anschrift · Address	Postanschrift · Mailing address
(089) 17 86 36-0	(089) 1 78 40 33 (089) 1 78 40 34	info@diehl-patent.de www.diehl-patent.de	Augustenstrasse 46 D - 80333 München	P.O. Box 34 01 15 D - 80098 München

A first hollow cylinder 31 made of metal is disposed with a distance about coil 30 and fixed to mounting pin 26 by a tab 32. A second hollow cylinder 33 made of metal and having a larger diameter surrounds hollow cylinder 31 and is fixed to the other mounting 27 by a tab 34.

The function of the illustrated arrangement is as follows: the coil 30 is heated by a current flowing there-through to a high temperature such that the coil emits electrons impinging on the pin-shaped cathode body 20 since the latter has a positive electric potential with respect to the coil. The metal portion 21 is bombarded with electrons and heated thereby to a relatively high temperature. The heat is conducted to the pin portion 22 such that the pin portion 22 emits electrons. Since the portion 22 is made of a material having a higher electron emitting property than the metal portion 23, there is no need to heat the metal portion 23 to such a high temperature as in the conventional situation where the whole cathode body is made of a material having a low electron emitting property. On the other hand, the metal portion 21 disposed in the bombarding zone has a higher melting temperature and a lower vapor pressure as the emitting portion 22, such that the metal portion 21 is better able to withstand the heat conditions as compared to a cathode body made of the material having the high electron emission property. The lifetime of the illustrated composite cathode body 20 is substantially higher than the lifetime of a cathode body made of only the one or the other material, under the provision that the emission power at the free end of the cathode body is the same.

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